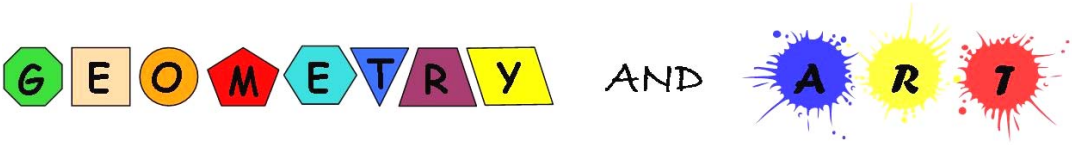


# Geometric Treats

## Big Ideas

### Unit of Instruction

**Trick or Treat Geometry** (Original Idea from LaRon Smith. Used with permission)* Using commonly available candy or treats, the student will correctly identify, define, draw, and shade the geometric form. The student will also speculate on the reason the form was chosen for the candy, related words, and other examples of objects that also have the same general shape. They will present this to the teacher for a grade. Afterwards the students will ingest their new knowledge by eating it!

### Geometry Concept

Geometric forms/polyhedra identification, classification, and relations

### Rationale

This is a fun activity that introduces students to the concept of two-dimensional geometric shapes and three-dimensional geometric forms. Students enjoy the process of analyzing different shapes and forms and gain concrete knowledge by drawing them. The project is both fun and informational.

### NCTM 9-12 Standards

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Use visualization, spatial reasoning, and geometric modeling to solve problems.
- Select and use various types of reasoning and methods of proof.
- Build new mathematical knowledge through problem solving.
- Solve problems that arise in mathematics and in other contexts.
- Recognize and apply mathematics in contexts outside of mathematics.

### Idaho Content Standards

- G.4.1.1 Analyze properties and determine attributes of two- and three-dimensional objects.
- G.4.1.2 Explore congruence and similarity among classes to two-dimensional objects and solve problems involving them.
- 9-12.VA.3.1.1 Select and apply media, techniques, and processes effectively and with artistic intention.
- 9-12.VA.3.1.4 Present convincing or accurately rendered subjects that demonstrate refined observational skills.

## Background

### Vocabulary

| | |
|---|---|
| Cones | Prismatoidal Polyhedra |
| Cylinders | Shape |
| Disc | Spheres |
| Form | Torus |
| Frustra | Truncated Prism |
| Parabaloid | Vanishing Point |
| Perspective | |

### Math Instruction (pre- or post-project)

Students should already be familiar with the following terms: cylinders, pyramids, cones, and spheres.
The students should also be familiar with value and how to draw and shade geometric forms. A short review of 2-D/3-D shapes and forms is provided, see page 13.

## Driving Question

### Project Objective

Using candy or other treats, the student will correctly identify, classify, define, draw and shade the geometric form. The student will also speculate on the reason the form was chosen for the candy, any related words, and any other examples of objects that also have the same general shape.

### Questions to be Answered

How can polyhedra be classified from general to specific?
What is a frustum?
How can frustra be applied to polyhedra?
Can frustra be applied to non-polyhedra forms?
In what ways? Are there limits?
What is truncation?
How can truncation be applied to polyhedra?
Can truncation be applied to non-polyhedra forms?
In what ways? Are there limits?
Can rules of classification be applied to non-polyhedra forms?
Do the non-polyhedra forms have to be regular?
How does it relate to axis of symmetry?
What is the difference between a shape and a form?

## Materials

### Materials Required

- Handout: prismatoidal polyhedra (see page 10).
- Handout: geometric treat student worksheet (see page 11).
- Example of geometric treat student worksheet completed to hang on wall (see page 12).
- Small paper bags to hold the treats (one for each student)
- Candy treats (students sign up to bring these)
- Drawing paper and pencils for drawing 3-D forms

### Reference Materials

Mathematics Dictionary
Mathematics Encyclopedia

## Lesson Outline

### Description of Activity

Introduction: Day One
Introduce homework assignment, due date, and give student worksheet
Discuss handout
Pass around sign up sheet for treats

Student Presentation: Day Two
Hand out paper sacks to each student as they enter the class
Students distribute treats
Students in groups classify geometric forms of candy
Student presentation
Students eat the treats

### Day One

**Introduction** 20-50 minutes

- Introduce the homework assignment and due date.
- Next discuss geometric forms. If students have not already done so, have them draw 2-D and 3D shapes and forms, using proper shading on 3-D forms.
- Give the handout on prismatoidal polyhedra, page 10, with a brief explanation.
- Finally, have students sign up for treats, see pages 8-9. Each student will bring one of their treats for each person in the classroom. Caution students not to lose the handout as they will be using it again later.

## Day Two

**Student Presentation:** 45 minutes

- As each student comes through the door, hand them a paper sack to place at their desk.
- Have each student place one of their treats into each paper sack.
- In partners or small groups, have students list each kind of candy in their sacks.
- Using their prismatoidal polyhedra handout, have each student identify the geometric form of each candy in its most specific form. List answers next to candy names.
- Then have each student stand up and present their Geometric Treat Student Worksheet. The students may make corrections of their candy lists.
- The teacher will collect the Geometric Treat Student Worksheet to grade.
- Finally, have the students ingest their knowledge (eat the treats)!

## Assessment

### Rubric

Set up a direct point value for each portion of the student worksheet worth a total of 35 points (with a possibility of six points extra credit):

1 point – name
1 points – date
1 points – name of geometric treat
3 points – geometric form
3 points – definition
3 points – brought treat for everyone on due date
6 points – accurately drawn in 3-D
2 points – shaded correctly
6 points – Cross section drawing
3 points – Why the shape was chosen
3 points – Related words
3 points – Other examples
35 points Total

## Ideas for Further Independent Student Project

Students could construct the geometric form out of cardboard on a larger scale.

Students could create large scale drawings of geometric shapes with proper shading.

Students could create a poster of hand-drawn candies, labeled with geometric shapes.

Students could calculate the surface area and volume of the treat.

Students could theorize on possible wrapping ideas.

Students could suggest other forms that would appear to give the same or greater volume when actually using less material. Then students could discuss other cost and marketing factors that may make the new form more or less desirable. As a further extension they could submit their findings to the candy company for their review.

Knowledge and research could be applied to cereal shapes.

An understanding of geometric forms could be applied to aerodynamics and spy planes.

## **Treats** **Geometric Form** (Teacher Resource)

| | |
|---|---|
| Andes Mint | Prismoid |
| Bonkers | Rectangular prism |
| Carmello | Rectangular prism & square pyramidal frustum |
| Candy Nickel | Cylinder, disc |
| Carmel | Cube |
| Cupcake | Concave 40-agonal frustum |
| Chocolate Kiss | Cone |
| Dots | Parabaloids |
| Donut | Ring of Torus |
| Dixie Cup | Circular frustum |
| Good & Plenty | Cylindresphere |
| Gum drop | Parabaloid |
| ICE candy | Prismoid or spherical cap |
| Ice cream cone | Cone |
| Jaw breaker | Sphere |
| Kit Kat | Prismoid |
| Laffy Taffy | Square Prism |
| Life Savers | Ring of Archimedes or Torus |
| Malted milk ball | Sphere |
| M&M candy | Ellipsoid |
| Muffin | Circular frustum |
| Necco Wafer | Cylinder, disc |
| Pizza | Cylinder |
| Pizza slice | Sector |
| Pringles chip | Hyperbolic parabaloid |
| Reese’s cup | Concave 40-agonal frustum |
| Rolo candies | Circular frustum |
| Snickers | Prism |
| Stick of gum | Rectangular prism |
| Sugar cookie | Cylinder or disc |
| Sunburst candy | Square prism |
| Tootsie Roll | Cylinder |
| Wax lips | Lipzoids |

# Treats Sign Up Sheets

Andes Mints _____

Bonkers _____

Carmello _____

Candy Nickels _____

Carmel _____

Cupcakes _____

Chocolate Kisses _____

Dots _____

Donuts _____

Dixie Cup _____

Good & Plenty _____

Gum Drops _____

ICE candy _____

Ice cream Cone _____

Jaw Breaker _____

Kit Kat _____

Laffy Taffy _____

Life Savers _____

Malted Milk Balls _____

M&M candy _____

Muffins _____

Necco _____

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# Treats Sign Up Sheets (continued)

Pizza _____

Pizza pieces _____

Pringles Chips _____

Reese's Cups _____

Rolo candies _____

Snickers _____

Stick of Gum _____

Sugar Cookie _____

Starburst candy _____

Tootsie Roll _____

Wax Lips _____

**PRISMATOIDAL POLYHEDRA**
*Properties of each classification*

Prismatoid: The bases of a prismatoid are polygons in parallel planes, and all of the vertices of the prismatoid lie in one or the other of these two planes. The lateral faces are triangles, trapezoids, or parallelograms.

Prismoid: A prismatoid whose bases are polygons having the same number of sides. The lateral faces are trapezoids or parallelograms.

Frustum: A special prismoid formed between the base of a pyramid and a plane parallel to that base. The lateral faces are often isosceles trapezoids, and the bases are often regular polygons.

Prism: A prismoid whose bases are congruent polygons. Lateral faces are parallelograms. Right prisms have bases perpendicular to the lateral edges. Lateral faces of a right prism are rectangles. Oblique prisms have bases that are NOT perpendicular to the lateral edges. The lateral faces are parallelograms.

Parallelepiped: A prism whose bases are parallelograms. (All six faces are parallelograms.)

Rectangular Prism: A parallelepiped whose bases are rectangles.

Right Rectangular Prism: A rectangular prism whose bases are perpendicular to the lateral edges. All six faces are rectangles. (Also called a rectangular solid or a rectangular parallelepiped.)

Cube: A right rectangular prism whose six faces are squares.

## Related Solids

Truncated Prism: That portion of a prism lying between two nonparallel planes which cut the prism and have their line of intersection outside the prism. The lateral faces may be trapezoids as well as parallelograms

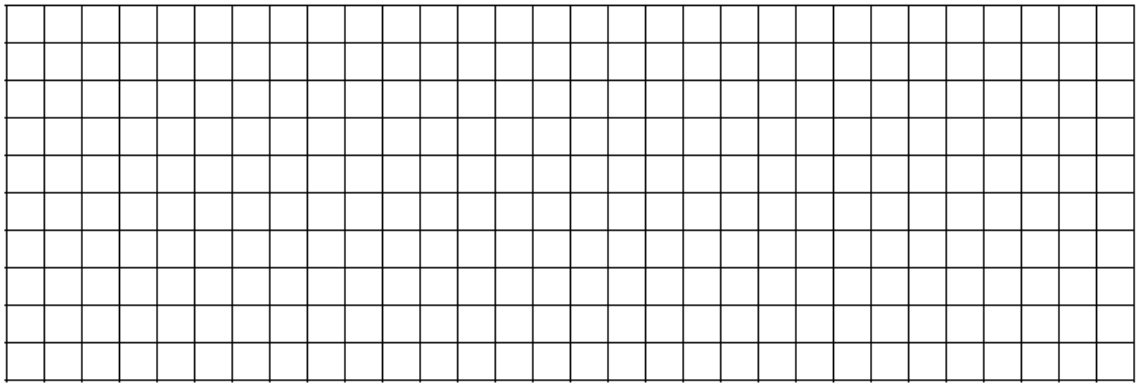
Right Truncated Prism: A truncated prism in which one of the two nonparallel planes is perpendicular to a lateral edge. The lateral faces are either rectangles or right trapezoids.

GEOMETRIC TREAT_____

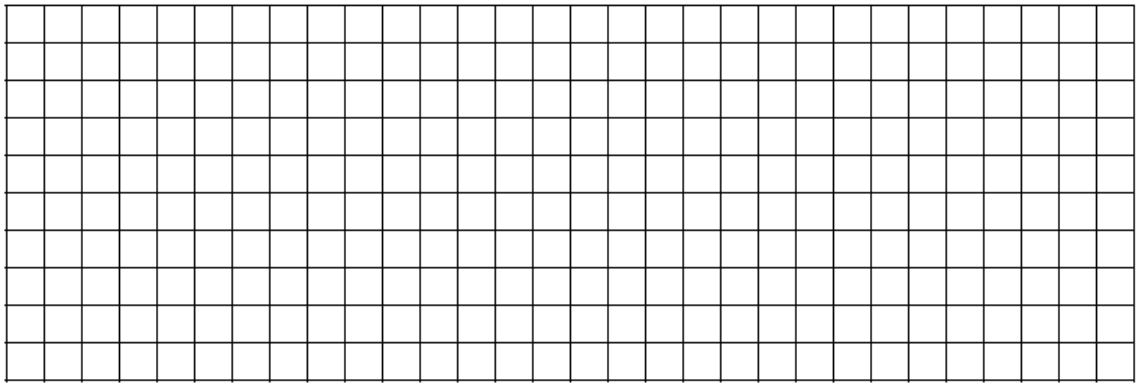
Geometric Shape _____

Definition: _____
_____
_____ _

Three Dimensional Drawing:



Cross Section or Graph Drawing:



Why was this shape chosen for this object: _____?
_____
_____
Related words that are similar (from Thesaurus) _____
_____
Examples of objects that also have this same general shape: _____
_____
_____

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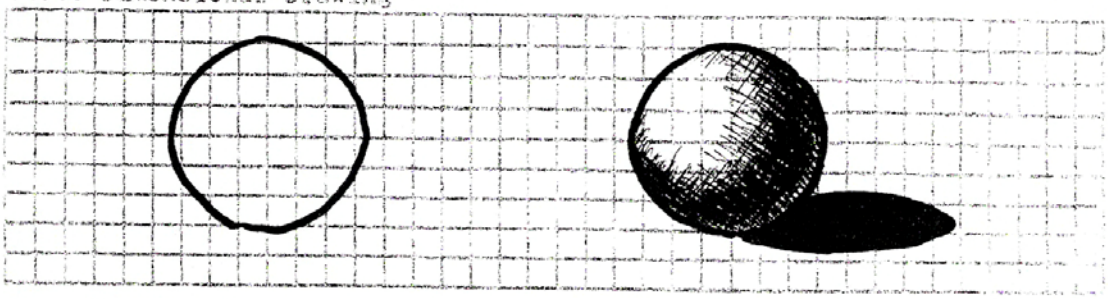
GEOMETRIC TREAT Gum Ball

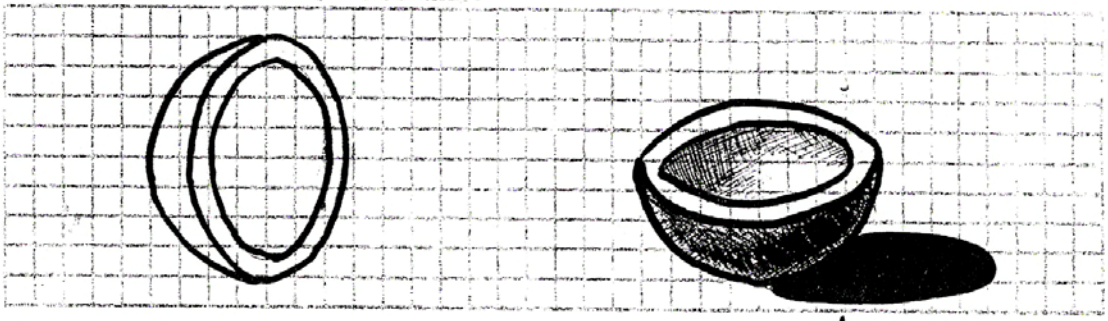
Geometric Shape Sphere

Definition The locus of points in space having a given fixed distance from a given point

Three Dimensional Drawing



Cross Section or Graph Drawing



Why was this shape choosen for this object: easy to produce in large quantities, consumer feels he is getting more because of the larger size thus increases of sales

Related words that are similar. (from Thesaurus)

spherical, ball, globe, orb, ampullaceous

Examples of objects that also have this same rounded shape

cannon ball, golf ball, baseball, celestial body, fish bowl, eyeball, ball-and-socket joints

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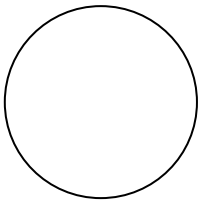
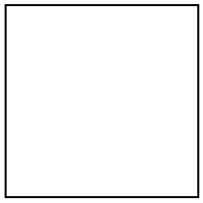
# BASIC STEPS TO DRAWING GEOMETRIC FORMS

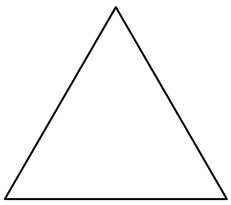
## 2-Dimensional Shapes



Circle



Square

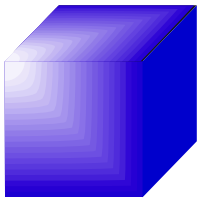


Triangle

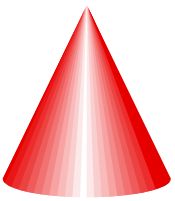
Rectangle

## 3-Dimensional Forms

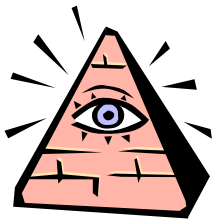
Sphere



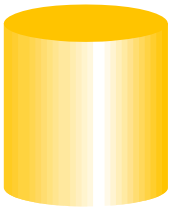
Cube



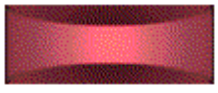
Cone



Pyramid



Cylinder



Slab

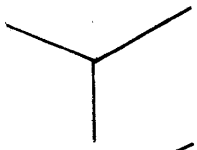
# FORM DRAWING

## RECTANGULAR PRISM

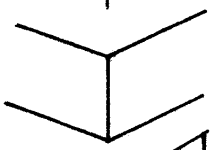
1. Vertical line



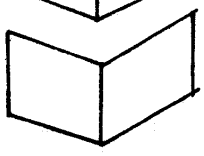
2. "V" shape on top



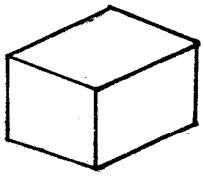
3. "V" shape on bottom



4. Two vertical lines
   for sides



5. Inverted "V" shape
   On top

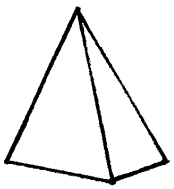


## PYRAMID

1. Inverted "V" shape

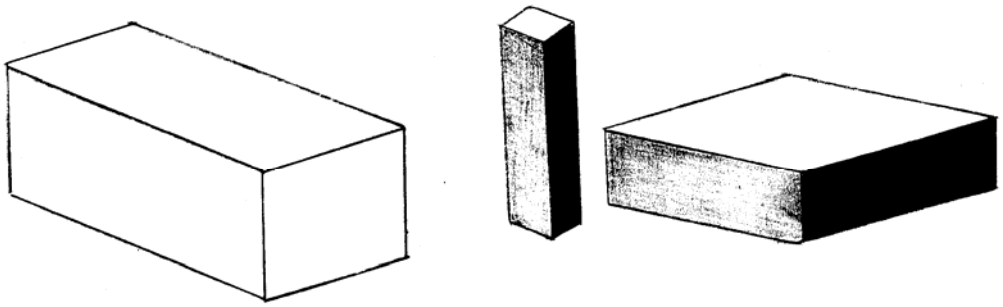
2. Longer interior diagonal

3. Connect the bottom with
   Straight lines

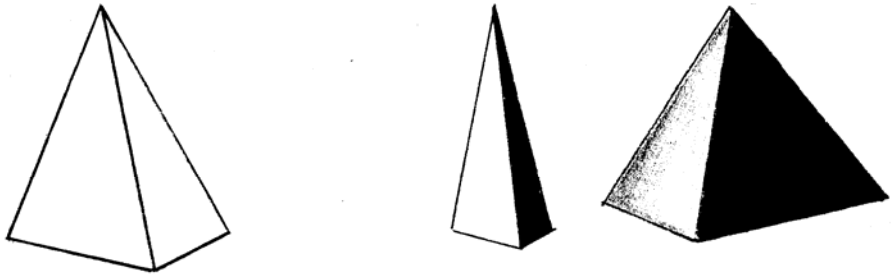


## **VALUE FORMS** (Shading)

RECTANGULAR PRISM
Has three values: a light side (nearest the light source), a medium side, and a dark side

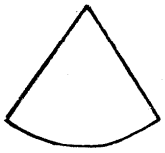


PYRAMID
Has two values: a lighter side and a darker side

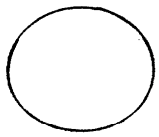


CONE
1. Inverted "V" shape

2. Flat smile along bottom
(No straight bottoms)

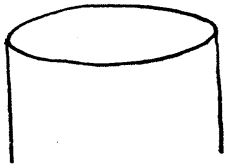


SPHERE
1. Draw a circle

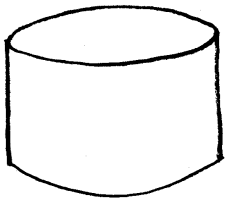


CYLINDER
1. Flat oval for top

2. Two vertical lines
(The same length)

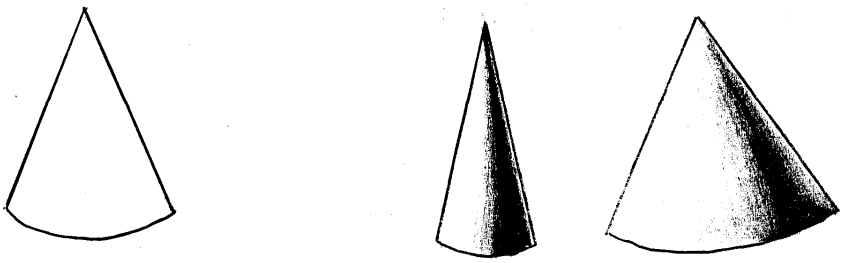


3. Flat smile along bottom
(No straight bottoms)



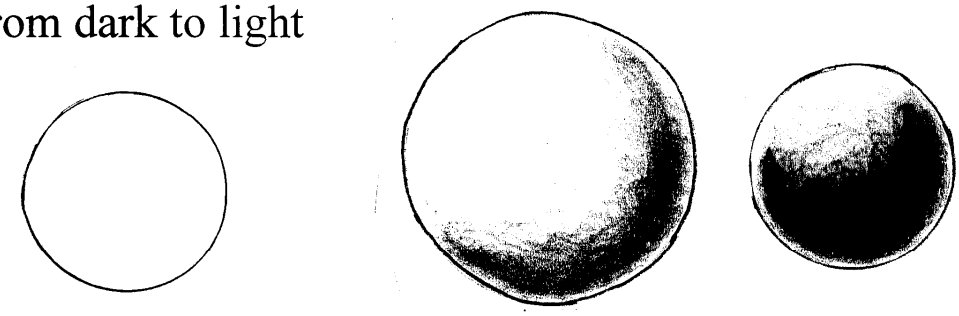
CONE

Has a value gradation in triangular shapes from dark to light



SPHERE

Has a value gradation in crescent or "C" shapes from dark to light



CYLINDER

Has a value gradation from dark to light